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noticed ordinarily except through long familiarity with the bones themselves.

M. Hue's drawings serve to emphasize the fact that the text-books of osteology and mammalogy have failed to make the most of the characters offered by the scapula, humerus, femur and other limb bones, although such characters are very important to the fossil bone hunter in the field, and also sometimes give indications of affinity between two forms whose skulls and dentition have become widely divergent. In this connection, in view of the sharp ordinal and family differences in the tarsus and especially the astragalus, it is rather curious that the author devotes so many plates to the tibia and fibula, which are usually less clearly distinctive, and yet only figures the tarsus of two forms, the dog and the reindeer.

In conclusion, M. Hue may be assured that his work will be of use not only to the archaeologist, but also, and to a considerable degree, to the student of mammalian osteology. The work, of course, covers only a rather limited fauna, but its method and example are alike valuable. It would greatly widen the general intelligibility of osteology if the skeletal parts of all the more important genera of mammals, both living and fossil, could be represented in plates similar to those of M. Hue, but arranged historically, *i. e.*, according to the best views of their evolutionary sequence. This would naturally be a large undertaking, but no bigger for the twentieth century than DeBlainville's *Osteographie* was for the first half of the nineteenth century.

WILLIAM K. GREGORY

*Essai sur la Valeur Antitoxique de l'Aliment Complet et Incomplet.* By A. LERENARD. Paris, J. Mersch. 1907. 8vo; pp. 211.

It is seldom that a work appears which has more interest for general physiology than the present one. Starting with a study of the toxic action of copper salts upon *Penicillium glaucum*, the author has incepted a series of illuminating experiments upon the ability of the different essential nutrient elements to function as antitoxic agents. The action of the various salts and ions was tested in all

combinations possible, always in the presence of a suitable source of carbon.

While the idea of an antidoting action between elements is not new, it has never before been so extensively investigated as an antagonistic relation between foods and poisons.

The author presents a lengthy review of literature upon the general subject of toxicity and antidoting action, but unfortunately devotes little attention to the work which has been done since 1900. It is to be especially regretted that the discussion does not include the investigations upon the antidoting action of physiologically balanced solutions by Loew, Loeb, Osterhout, Duggar, Benecke and others.

The chapter on the general biology and physiology of *Penicillium glaucum* gathers up and coordinates much of the modern and early work upon this classical and oft-investigated fungus. The chapter upon the physiological rôle of the essential nutrients seems conspicuously brief in comparison with the treatment accorded other subjects of like importance. Nitrogen, potassium and phosphorus receive a brief elementary treatment; the other mineral elements are very briefly dismissed.

The author's extended discussion of the nature of toxicity contains numerous points of special interest for the student of physiology, a few of which deserve mention in passing. He emphasizes the necessity for distinguishing between injurious effects due to the osmotic strength of the solution and those actually due to poisons, especially since the former may be brought about by non-toxic substances.

Following the classification of Chassevant and Richet, which distinguishes between antigenic and antibiotic concentrations of the toxic agent, LeRenard distinguishes the antiauxic and antibiotic concentrations of copper for *Penicillium glaucum*. The antiauxic concentration is defined as the one which allows the fungus spore to germinate and produce some sort of a germ tube, but does not allow the development of the same into a thallus. It is admitted that antiauxic effects may also be produced by a paucity of nutrients. By diminishing the amount of poison, a sufficiently weak concentration is finally reached

which will allow the fungus thallus to make a good growth, but prevent it from forming organs of fructification; this is the antigenetic concentration. The antibiotic concentration is one sufficient to kill an adolescent thallus; however, two sorts of antibiotic effects are exhibited by thallophytes when acted upon by poisons. (1) Before reaching the fatal concentration, a point is found at which the plant ceases to grow. This point is designated the partial antibiotic concentration, and may be represented by an action analogous to that of ether or chloroform, which deadens or suppresses some of the functions. (2) The total antibiotic concentration causes a sudden and complete termination of the vital functions.

In estimating the effect of toxic solutions in his investigation, LeRenard made use of a new standard. On account of the very dilute solutions sometimes used, the fungus could make but little growth and the usual criterion of dry weight was inapplicable. He, therefore, determined what was practically the antiauxic concentration in each case. This was determined by ascertaining the point at which the majority of spores became vacuolate, transparent, and with some swelling assumed a spherical or elliptical form, *i. e.*, *utricular germination*. Such a spore, if transferred to a nutrient solution, will germinate and develop a normal thallus; but left in the antiauxic solution, it develops no further than the germ-tube stage.

The complete nutrient solution used contained  $C_6H_{12}O_6 + NH_4NO_3 + MgSO_4 + KH_2PO_4 + H_2O$ . The experiments consisted in determining the maximum concentrations of four salts of copper (the acetate, chloride, nitrate and sulphate) which would allow the utricular germination in the presence of a complete or incomplete nutrient. The results obtained may be briefly summarized as follows:

Neither single mineral salts in solution weaker than the normal, nor organic compounds containing no acid or metal radicals, have any antitoxic value against copper salts for *Penicillium glaucum*; but the salts of K, Mg,  $NH_4$ , or organic acids which contain in their structure the groups  $CH_3$ ,  $CH_2$ , or CH

singly joined to a functional acid group possess an antitoxic value.

The bases combined with active organic acids determine the relative antitoxic value of the salts of these acids.

The amine group  $NH_2$  destroys the antitoxic value of  $CH_3$ . The imide function,  $OCN$ , is more or less indifferent. The nitrile group,  $CN$ , is distinctly toxic. The organic combinations of C and of N taken singly are therefore inactive.

Carbohydrates, when added to an appropriate mineral salt, exhibit an antitoxic value, which for a constant quantity of appropriate salt vanishes at about the centinormal concentration with aldoses; but goes somewhat higher for ketoses and complex hexoses. The aldehyde and ketone functions play, therefore, a very important function in the antitoxic action of these bodies. The position of the hydroxyl groups in the carbohydrates has very little influence upon the antitoxic value.

The appearance of antitoxic action is dependent upon the simultaneous presence of a combined carbon compound, and of a suitable mineral salt forming an organo-metallic compound, which recalls by its formation and modifications the side-chain of Ehrlich.

The antitoxic value of the carbon group in a mixture varies with the quantity of metal or of mineral salt united to this carbon group.

The dissociation of the mineral salts induces a sudden decrease in their antitoxic value, and the molecules of the useful salts (organic or inorganic combined with carbon compounds) generally appear more active than the ions for the K and Mg salts and also for certain salts of  $NH_4$ . The effect of the ions is generally independent of their quantity. Sometimes their effect diminishes proportionally to their quantity, but generally there must be a material diminution in quantity before any effect can be noticed.

Certain salts exhibit specific properties. The antitoxic value of the  $NO_3$  ions becomes zero when the total quantity of  $NO_3$  in solution becomes equal to or less than 0.000352 per cent.  $SO_4$  shows the same phenomenon when the quantity becomes 0.000096 per cent. In the presence of an excess of K, the ions

$\text{NO}_3$  and  $\text{SO}_4$  are only active when the former occurs in the ratio of 10:1 of K, and when the latter is present as 200:1 of K. The influence of molecules and ions is zero when phosphates are used.

Magnesium salts possess a greater antitoxic value than the corresponding potassium or ammonium salts. Mixing a small quantity of  $(\text{CHOO})_2\text{Mg}$  with twice the quantity of CHOOK does not modify the antitoxic value of the former in the presence of copper acetate, but with the other salts of copper its value is increased. The addition of ammonium or potassium salts to a solution of the corresponding magnesium salt decreases but does not increase the antitoxic value of the latter. The mixture of corresponding salts of potassium and ammonium, however, increases slightly their antitoxic value in the presence of some copper salts, but not for others.

A part of the antitoxic activity of mineral salts is due to the acid radicals, the  $\text{NO}_3$  radical being the one which is most active. Therefore the inorganic salt possessing the most antitoxic activity is  $\text{Mg}(\text{NO}_3)_2$ .

By mixing a small quantity of  $(\text{NH}_4)_2\text{SO}_4$  with twice the amount of CHOOK, the antitoxic value of the former is not modified, except in presence of copper acetate, where the antitoxic value is slightly increased. The K ions appear to decrease the antitoxic value of the  $(\text{NH}_4)_2\text{SO}_4$  molecules. When  $(\text{CHOO})_2\text{Mg}$  molecules are added to  $(\text{NH}_4)_2\text{SO}_4$  the antitoxic value of the Mg molecules decreases. The mixing of a small quantity of  $\text{NH}_4\text{NO}_3$  molecules with an equal quantity of CHOOK increases their antitoxic value. The K ions are depressing when they are present in large amounts, but have the same action as CHOOK when they are present in small numbers. When  $\text{NH}_4\text{NO}_3$  is added to less than half the same amount of  $(\text{CHOO})_2\text{Mg}$ , the first salt exerts a depressing action upon the second.

The addition of a small amount of CHOOK to less than half the same quantity of  $\text{Mg}(\text{NO}_3)_2$  diminishes the antitoxic value of the latter except with the copper acetate, where it is increased. The addition of CHOOK to  $\text{S} + \text{NH}_4 + \text{Mg}$  or to  $\text{P} + \text{NH}_4 + \text{Mg}$

raises the antitoxic value of these combinations.

When a small quantity of  $\text{MgSO}_4$  is added to twice as much  $\text{NH}_4\text{NO}_3$  the antitoxic value of the mixture is greater than that of the  $\text{NH}_4\text{NO}_3$  alone, but is greater, equal or less than that of the  $\text{MgSO}_4$  with different salts of copper. The addition of CHOOK to the mixture is without action upon the antitoxic value, except with  $\text{CuCl}_2$ , where it is lower.

The mixture of a small amount of  $\text{NH}_4\text{H}_2\text{PO}_4$  with a smaller amount of  $\text{Mg}(\text{NO}_3)_2$  diminishes considerably the value of the latter. The addition of CHOOK to the two salts raises their antitoxic value.

Mixing a small amount of  $\text{Mg}(\text{NO}_3)_2$  with twice the amount of  $\text{NH}_4\text{H}_2\text{PO}_4$  and an equal amount of  $\text{K}_2\text{SO}_4$  represents a complete mineral nutrient and the maximum of resistance to poison.

The author's conclusions are sustained by a large mass of experimental data which will repay careful reading and constitute an important addition to our knowledge of the relations between poisons and foods.

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*Kurzes Lehrbuch der Organischen Chemie.*

By DR. W. A. NOYES. Translation into the German by W. OSTWALD. Pp. 722. Akademische Verlagsgesellschaft, 1907.

It has seldom happened that an English text in organic chemistry has been translated into the German, inasmuch as organic chemistry is essentially a German science, and practically all of our texts have come from that country. That W. A. Noyes's book has been translated into the German augurs well for organic chemistry in our own country. Especially does this seem true when it is noted that the translator is no other than Walter Ostwald, of Leipzig. The translation is remarkable. The translator has given a faithful representation of the original text, at the same time he has completely eliminated that stiffness so characteristic in translations of this kind.

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